CLAIMS

What is claimed is:

1 1. A call processing system for monitoring status of a call in a network

2   comprising:

3   a first set of sensors connected to one or more subscriber or PSTN network

4   circuits, the first set of sensors configured to sense raw call progress

5   signaling information on the circuit;

6   a second set of sensors connected to a call control channel of a next

7   generation telephony network (NGTN) network element, the second

8   set of sensors configured to sense NGTN call control message

9   information from the NGTN network element; and

10   an event analyzer coupled to the first set of sensors and the second set of

11   sensors, the event analyzer configured to:

12   selectively receive the raw call progress signaling information and the

13   NGTN call control message information, and

14   process the raw call progress signaling information and the NGTN

15   call control message information to generate logical call handling

16   events.

1   2. The system of claim 1, wherein the event analyzer comprises a call progress

2   event analyzer coupled to the first set of sensors and configured to receive

3   the raw call progress signaling information, the call progress event analyzer

4   comprising:

5   a call progress event processor configured to:

6   convert the raw call progress signaling information into logical call

7   handling events,

8   pass the logical call handing events to a protocol independent call

9   processor, and

10   accumulate dialed and mid-call digit information for channel

11   associated signaling circuits and element information for

12   common channel signaling circuits; and

13   a call progress state machine configured to:

14   receive and analyze logical event information from the protocol

15   independent call processor, and

16   receive and analyze the digit information and the element information

17   from the call progress event processor.

1   3. The system of claim 1, wherein the event analyzer further comprises a NGTN

2   event analyzer coupled to the second set of sensors and configured to receive

3   the NGTN call control message information, the NGTN event analyzer

4   comprising:

5   a NGTN message processor configured to:

6   decode NGTN call control message information,

7   convert the NGTN call control message information into logical call

8   handling events, and

9   pass the logical call handling events to the protocol independent call

10   processor; and

11   accumulate call control message information element information;

12   and

13   a NGTN state machine configured to:

14   receive and analyze the logical event information from the protocol

15   independent call processor, and

16   receive and analyze call control message information element

17   information from the NGTN message processor.

1   4. The system of claim 1, further comprising the protocol independent call

2   processor configured to selectively receive the logical call handling events

3   from the event analyzer, the protocol independent call processor comprising:

4   a timer processor coupled to the event analyzer, the timer processor

5   configured to:

6   calculate an elapsed time from a previous call progress event or an

7   elapsed time from a previous NGTN message event, the elapsed

8   time causing an elapsed-time event for the call progress state

9   machine or the NGTN state machine,

10   enable one or more timers used to determine wait time for an

11   expected call progress event or NGTN message event, wherein

12   an expiring timer causing an expired-timer event for the call

13   progress state machine or the NGTN state machine, and

14   send the logical call handling event to the call progress state machine

15   or the NGTN state machine.

1   5. The system of claim 4, further comprising a call status handler configured to:

2   maintain current call status information for each call progress event

3   received from the call progress event processor, wherein a capturing

4   of the raw call progress signaling information by the first set of

5   sensors is indicative of an occurrence of the call progress event, and

6   maintain current call status information for each message event received

7   from the NGTN message processor, wherein a capturing of the NGTN

8   call control message by the second set of sensors is indicative of an

9   occurrence of the message event.

1   6. The system of claim 4, further comprising a state tracker configured to track

2   a current state of the call progress state machine and of the NGTN state

3   machine, the state tracker providing call state information and call status

4   information to the call progress state machine and the NGTN state machine,

5   the current state used by the call progress state machine and the NGTN state

6   machine to transition to a new state.

7. The system of claim 6, wherein the transitioning from the current state to the new state is dependent on the current call status from the call status handler and a new call progress event received from the call progress event processor or a new message event received from the NGTN message processor.

8. The system of claim 7 wherein, upon transitioning to the new state, the call progress state machine and the NGTN state machine update the call status handler with a new call status, update the state tracker with the new state, inform the timer processor that a current cycle is completed, and when required, enable a new timer in the timer processor.

9. The system of claim 4, further comprising a call processor executive configured to:

   receive the call state information and the call status information,

   translate the call state information and the call status information, and

   transmit the translated information to an external device.

10. The system of claim 4, wherein the timer processor is further configured to select a most recent call progress event or message event and clock the call progress state machine or the NGTN state machine respectively, and wherein, when clocked, the call progress state machine analyzes the most recent call progress event and the NGTN state machine analyzes the most recent message event.

1   11. The system of claim 10, wherein, after the most recent call progress event or

2   message event is analyzed, the protocol independent call processor, the call

3   progress state machine and the NGTN state machine wait for a next call

4   progress event or message event to occur.

1   12. The system of claim 10, wherein the timer processor is further configured to

2   determine wait time for an expected call progress event or message event

3   based on receipt time of the previous call progress event or message event.

1   13. The system of claim 1, further comprising a multi-protocol call analyzer

2   triggered by the timer processor at timer expiration and at end of NGTN

3   state machine or Call Progress state machine cycle, the multi-protocol call

4   analyzer configured to:

5   use information from the call status handler to transition to a new state,

6   wherein a state of the multi-protocol call analyzer comprises an alarm

7   state or error state, a new analysis state, or both the alarm state and

8   the new analysis state,

9   pass the new analysis state information to the state tracker,

10   pass a new call status information to the call status handler,

11   pass a new timer set information to the timer processor, and

12   notify the timer processor and an alarm handler when entering the alarm

13   state.

1   14. The system of claim 1 further comprising an alarm handler configured to:

2   receive call handling error information corresponding to the alarm state

3   from the multi-protocol call analyzer,

4   accumulate alarm counts, and

5   trigger an alarm message to external network management systems when

6   the alarm count exceed a defined threshold.

1   15. The system of claim 1 wherein the call progress event processor and the

2   NGTN message processor continues to receive raw call signaling information

3   and NGTN call control message information while the call progress state

4   machine and the NGTN state machine selectively analyze the current call

5   progress event and message event.

1   16. A method, comprising:

2   sensing a raw call progress signaling information from one or more

3   subscriber or PSTN network circuits;

4   sensing a next generation telephony network (NGTN) message information

5   from a NGTN call control channel of a network element;

6   generating logical call handling events from the raw call progress signaling

7   information and from the NGTN message information; and

8   processing the logical call handling events corresponding to the raw call

9   progress signaling information and the NGTN message information.

1   17. The method of claim 16, wherein the raw call progress signaling information

2   is sensed at an occurrence of a call progress event, and wherein the NGTN

3   message information is sensed at an occurrence of a NGTN message event.

18. The method of claim 16, wherein generating logical call handling events

from the raw call progress signaling information comprises:

converting the raw call progress signaling information into the logical call

handling event;

setting an elapsed time event, the elapsed time being the time between the

call progress event and a most recent call progress event; and

determining if a timer expiration event occur, the timer set for an expected

call progress event.

19. The method of claim 18, wherein generating logical call handling events

from the raw call progress signaling information further comprises:

updating the current call status;

enabling a new timer when there is an expected call progress event; and

waiting for a next call progress event to occur.

20. The method of claim 16, wherein generating logical call handling events

from the NGTN message information comprises:

converting the NGTN message information into the logical handling event;

setting the elapsed time event to be the time between the NGTN message

event and a most recent NGTN message event; and

determining if the timer expiration event occur, the timer set for an

expected NGTN message event.

1   21. The method of claim 20, wherein generating logical call handling events

2   from the NGTN message information further comprises:

3   updating the current call status;

4   enabling a new timer when there is an expected NGTN message event; and

5   waiting for a next NGTN message event to occur.

1   22. The method of claim 16, wherein processing the logical call handling events

2   corresponding to the raw call progress signaling information and to the

3   NGTN message information comprises:

4   analyzing the logical call handling event, the timer expiration event, the

5   elapsed time event, and the current call status such that when an error

6   condition occurs an alarm is generated;

7   maintaining the current call status;

8   providing call records and analysis information associated with the call

9   progress event and the NGTN message event to external display

10   devices;

11   generating call status and call handling error information;

12   accumulating alarm counts, and

13   triggering an alarm message to external network management systems

14   when the alarm counts exceed a defined threshold.

1   23. A computer readable medium containing instructions which, when executed

2   in a processing system, causes the processing system to perform a method

3   for determining and monitoring status of calls in a network, comprising:

4   sensing a raw call progress signaling information from one or more

5   subscriber or PSTN network circuits;

6   sensing a next generation telephony network (NGTN) message information

7   from a NGTN call control channel of a network element;

8   generating logical call handling events from the raw call progress signaling

9   information and from the NGTN message information; and

10   processing the logical call handling events corresponding to the raw call

11   progress signaling information and the NGTN message information.

1   24. The computer readable medium of claim 23, wherein the raw call progress

2   signaling information is sensed at an occurrence of a call progress event, and

3   wherein the NGTN message information is sensed at an occurrence of a

4   NGTN message event.

25. The computer readable medium of claim 23, wherein generating logical call handling events from the raw call progress signaling information comprises:

converting the raw call progress signaling information into the logical call handling event;

setting an elapsed time event, the elapsed time being the time between the call progress event and a most recent call progress event; and

determining if a timer expiration event occur, the timer set for an expected call progress event.

26. The computer readable medium of claim 25, wherein generating logical call handling events from the raw call progress signaling information further comprises:

updating the current call status associated with the call progress event;

enabling a new timer when there is an expected call progress event; and

waiting for a next call progress event to occur.

27. The computer readable medium of claim 23, wherein generating logical call handling events from the NGTN message information comprises:

converting the NGTN message information into the logical call handling event;

5   setting the elapsed time event to be the time between the NGTN message

6   event and a most recent NGTN message event; and

7   determining if the timer expiration event occur, the timer set for an

8   expected NGTN message event.

1   28. The computer readable medium of claim 27, wherein generating logical call

2   handling events from the NGTN message information further comprises:

3   updating the current call status associated with the NGTN message event;

4   enabling a new timer when there is an expected NGTN message event; and

5   waiting for a next NGTN message event to occur.

1   29. The computer readable medium of claim 23, wherein processing the logical

2   call handling events corresponding to the raw call progress signaling

3   information and the NGTN message information comprises:

4   analyzing the logical call handling event, the timer expiration event, the

5   elapsed time event, and the current call status such that when an error

6   condition occurs an alarm is generated;

7   maintaining the current call status corresponding to the call progress event

8   and to the NGTN message event;

9   providing call records and analysis information associated with the call

10   progress event and the NGTN message event to external display

11   devices;

12   generating call status and call handling error information corresponding to

13   the call progress event and to the NGTN message event;

14   accumulating alarm counts; and

15   triggering an alarm message to external network management systems

16   when the alarm counts exceed a defined threshold.